NeoWarm: Engineering verification for a built-prototype of a biomedical device to prevent newborn hypothermia

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Introduction

Compared to babies born at full-term, premature and small babies are more susceptible to hypothermia (low body temperature), and more likely to perish, especially in countries with limited resources. One method for keeping babies warm in these settings is Kangaroo Mother Care (KMC), in which the mother and baby are in skin-to-skin contact. The NeoWarm project is focused on creating an affordable, effective, and feasible biomedical device that will allow caregivers in resource-limited areas to perform either KMC or use the device in a "stand-alone" mode to prevent hypothermia among vulnerable babies.

Methods

The NeoWarm project was composed of two teams of students from biomedical engineering (BME) and public health. The primary objective of the BME team was to perform engineering verification of an existing NeoWarm prototype. Methods included: (1) troubleshooting to determine existing functionality of the device; (2) reviewing the previous circuit design; (3) modifying the design to make it more efficient; (4) creating new circuit schematics utilizing revised instrumentation; (5) developing a LED light alarm system, to provide visual confirmation to caregivers of device functioning. The revised schematics were then (6) utilized to build a new circuit which was (7) integrated into the device.

Results

Successful engineering verification was conducted, and a revised prototype was created which performed crucial device tasks including: (1) continuous body temperature monitoring of the infant while in the device, in both KMC and stand-alone modes; (2) automatic triggering of the heating element when the infant's body temperature drops; (3) consistent visual feedback as to device readings and functioning mode (e.g., "cold/heating" = blue; "temperature stable" = white; "too hot" = red).

Conclusion

The NeoWarm prototype is more efficient, effective, and robust. These strides should allow for future progression of the NeoWarm device towards becoming a viable solution to support the health of neonates around the world.

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